

Improving the Fleet's Ability to Process Plastic Waste

Enhanced Shipboard Processors Compress Waste for Long-Term Storage

On an average day, a U.S. Navy aircraft carrier generates between 1,000 to 1,500 pounds of plastic waste. Smaller ships produce between 50 and 80 pounds each day. Keeping in mind that the average 32-gallon recycling can used at home holds about six pounds of plastic waste, you can imagine how important it is for the Navy's ships to effectively process their plastic waste for storage until they can offload it.

The Plastics Waste Processor (PWP) is used by the Fleet to process shipboard

generated plastic waste into dense, sanitary disks suitable for long-term storage. These processors allow ships to retain their plastic waste while at sea in compliance with zero-plastic waste discharge restrictions, allowing them unrestricted operation throughout the world.

The development of the plastics processing technology started in 1993. By the end of 1998, more than 600 processors were installed Fleet-wide. Fleet operations have shown that the current PWPs require excessive man-hours to operate and have high corrective and preventative maintenance costs.

In FY00, the Naval Sea Systems Command (NAVSEA) directed Carderock Division's Environmental Quality Department to improve the PWP design. The initial goal was to reduce operational and maintenance man-hours associated with the equipment by 40 percent without modifying the shipboard interfaces.

Assessments were made on the failure rates of all components, corrosion, and system complexity. High failure rate components were removed or replaced. Materials were changed to reduce corrosion issues, and the system was greatly simplified to enhance reliability and ease maintenance. Replacement components and subsystems were designed, fabricated, and then tested for reliability and ruggedness in the laboratory and in the field. Pre-production units were tested in the laboratory for hardware and soft-



USS HARRY S. TRUMAN (CVN 75). Since the MOD 1 PWP's were installed on board in October 2002, over 5,000 disks have been processed on two modified compress melt units.

U.S. Navy photo by Photographer's Mate
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ware functionality and failure modes, safety, reliability, operability, maintainability, and process rate.

The modified plastics waste processor (MOD 1 PWP) has 34 percent fewer

components, and the resulting process time is 15 minutes less than the original design with two to three times the output weight. The electro-mechanical drive system was replaced with a single pneumatic actuator for compression,

and the lower frame of the unit was redesigned to be more open, allowing easier access for cleaning as well as more efficient waste and liquid flow through. This allows removal of two motor control contactors and the current transducer from the control panel. The temperature control system was greatly simplified by replacing the resistance temperature detectors with thermostatic switches, which also removed two modules from the programmable logic controller. Additionally, the chamber heaters were removed, allowing a more open lower frame and the removal of a contactor from the control panel.



Production grade modified plastics waste processor Compress Melt Units (CMUs), and Auxiliary Unit (AU) installed during prototype machinery alteration onboard the USS WHIDBEY ISLAND (LSD 41).

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The modified unit also incorporates nine self-cleaning nozzles that are connected to the ship's hot potable water service. This greatly reduces the amount of cleaning time and effort required by the ship's personnel. The new direct cooling system used with the auxiliary unit does not need a pump or a heat exchanger and has a total of 84 percent fewer parts than the current closed-loop cooling unit. The direct cooling system utilized by the auxiliary unit also cools the compress melt unit in about half the time of the original cooling system.

In the spring of 2003, the modified processor underwent shipboard testing on the USS HARRY S. TRUMAN (CVN 75), USS NASSAU (LHA 4), and USS MILIUS (DDG 69). The equipment remained onboard these ships throughout a six-month deployment. Shipboard evaluation was completed in the fourth quarter of FY03, and each test ship has decided to retain the

prototype equipment, instead of replacing their old units, until production equipment is available. So far, the results are very promising:

- The new MOD 1 PWP's were installed aboard the USS NASSAU (LHA 4) in July 2002. The ship deployed in August 2002. Since installation, only four of six compress melt units were being operated to handle the load, and the ship has processed more than 3,000 plastics disks with the modified system without any ram pulls as compared to a minimum of every 80 cycles with the current design.
- Installation took place on the USS MILIUS (DDG 69) in August 2002. The ship deployed in November 2002. One modified unit processed 100 percent of the ship's plastic waste, and more than 700 disks have been processed onboard without any ram pulls.



Modified plastics waste processor prototype installed for testing and evaluation next to current design unit on the USS MILIUS (DDG69) before deployment in July 2002.



USS MILIUS (DDG 69). One modified unit processed 100 percent of the ship's plastic waste, and more than 700 disks have been processed onboard.

U.S. Navy photo by Photographer's Mate 2nd Class Daniel J. McLain

■ The MOD 1 PWP's were installed in October 2002 aboard the USS HARRY S. TRUMAN (CVN 75), which deployed for seven months in December 2002. Since that time, over 5,000 disks have been processed on two modified compress melt units without any ram pulls. These two modified units processed 40 to 50 percent of the ship's plastic waste. Normally, an aircraft carrier would need nine to eleven of the original compressor melt units to process its plastic waste.

"The feedback from the test ships has been extremely good," said Schwegler. "So far, we've increased the processing rate of plastic waste over 200 percent over the old machine, reduced maintenance and operational manning by 50 percent, increased reliability by about 50 percent, and decreased cleaning by 60 percent. The ships really like it."

He continued, "The crews have been very impressed with the self-cleaning feature and report that the operation and cleaning times been reduced and

the odors in the spaces have been greatly reduced or eliminated. You must remember that these machines are processing food-contaminated plastic, and with the old closed systems, they got very dirty and were hard to clean." The modified unit has greatly improved the quality of work life for these sailors.

With such good results, Carderock Division has been granted approval from the Configuration Control Board in Washington, DC, to begin a Machinery Alteration (MACHALT) program for surface ships. The initial MACHALT involved two units installed on the USS WHIDBEY ISLAND (LSD 41) in July 2003. From that installation, the MACHALT instruction covering all installations will be written.

In the fall of 2003, a request for bids was released for the production of the plastic waste processors. NAVSEA estimates that installation will begin in the third quarter of FY04. All of the improvements are internal to the equipment, so no ship interface

changes, alterations or modifications will be required. The old equipment will be swapped for new equipment using existing foundations and the same electrical, air and water connections. In many cases, the ship will gain space because they will require fewer units than were previously needed. The improvements will be installed over a five-year period. ⚓

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